ON THE SHORT FOOTED UNGULATA OF THE EOCENE OF WYOMING.

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(*Read before the American Philosophical Society, Feb. 21st*, 1873.)

In no group of *Mammalia* have the determinations of palæontology been more significant than in the *Ungulata*. Here, in an especial manner, the anticipations of science have been realized, in the filling up of the numerous gaps in the series of living forms. Here especially is it evident, that the existing fauna is but a fragment, and that the faunæ of the past, as we know them to-day, are but the precursors of what we may bring to light to-morrow.

The primary range of variation in the structure of the *Ungulata*, has been generally admitted by zoölogists to be found in the structure of the limbs and feet. Three most prominent types have been distinguished on this basis, viz.: the *Artiodactyla*, *Perissodactyla* and the *Proboscidia*: with some of the lesser importance, those of the *Toxodontia* and *Hyracoidea*.* If we direct our attention to the detailed structure of the feet, or of the teeth, each division offers its own range of variation; witness in the *Artiodactyles* the differences between the *Ruminantia* and *Omnivora*, and in *Perissodactyla*, between *Equus* and *Rhinocerus*. In either order canines and incisors may be present or absent, and molars assume a great variety of patterns of enamel plication. The toes in the latter order may vary from four to one. Nevertheless, the most diverse genera are bound together by intermediate forms, often extinct. Connecting *Omnivora* and *Ruminantia* come *Oreodon*, *Merycopotamus*, *Tragulus*, *etc.* In *Perissodactyla*, *Anchitherium*, *Palæosyops*, *etc.*, connect the extremes.

The Proboscidians have, on the other hand, remained until recently an isolated group with but few representatives, hence its definition as an order, has been more or less obscured by characters of a special nature, drawn from the dentition, trunk, etc., which it has been found necessary to omit in characterizing the two orders above mentioned. These characters are so striking in their appearance as to suggest greater systematic importance than belongs to them. Thus the trunk is not more important as a character of the *Proboscidia*, than it is of the *Perissodactyla*, where the tapir alone possesses it. Nor are the complex molars and large tusks to be regarded as a definition, for in the *Phacochœrus* we have molars as compound as in some mastodons, huge canine teeth and no incisors below; characters very different from many Artiodactyles. Nor can we regard the exclusive union of the astragalus with the navicular as a final test, for in Perissodactyles the facet for union with the cuboid may be considerable (*Rhinocerus*) to almost nothing (*Equus*).

The occasion for this discussion is presented by the discovery by the

* *Vide* Gill, Arrangement of the Families of Mammals, Smithson. Misc., Coll., 1872, No. 230; the best analysis of the *Mammalia* yet published.

palæontologists of Hayden's geological surveys of 1871–2, of the remarkable types *Bathmodon*, *Uintatherium*, and *Eobasileus*. These genera contradict in several particulars the characters usually assigned to the *Proboscidia*, while they agree with them in others, and they thus present the problem of classification, which will ever recur so long as additions to our knowledge of the life of the past continue to be made. This problem is simply the question as to what characters shall be retained as definitive of natural divisions, on the discovery of intermediate forms. As our system is an expression of the possession of structural characters, our higher groups or orders are naturally expressions of the existence of the more comprehensive characters, or those present through the most extended series of species. Hence we believe them to be also those assumed earliest in time.

In the case of the *Ungulata*, the structure of the feet seems to define the greatest range of the species. Thus the *Artiodactyla* and *Perissodactyla* are digitigrade or unguligrade, while the *Proboscidia* are nearly plantigrade. The first order exhibits the equal development of the third and fourth toes; the second of the third toe, while in the *Proboscidia* the structure is like the last, with more numerous digits. But this order differs from both the preceding in the relations of the ulna and radius. In *Artiodactyla* and *Perissodactyla* the ulna diminishes greatly distally and presents but a small carpal articular surface obliquely behind that of the much larger radius. In *Proboscidia* the ulna presents the larger articulation with the carpus, and the radius crosses it obliquely, and presents its articular face alongside of the ulnar.

The characters of the three orders may be thus stated:

Proboscidia.*

Feet plantigrade but elevated behind by a plantar pad. Toes numerous, short, the middle (3d) largest. Hind limb with knee free from the body; tibia without spine; astragalus flat, not produced anteriorly. Fore limb with well developed ulna articulating extensively with the carpus along side of the smaller radius, which crosses it obliquely.

Perissodactyla.

Feet digitigrade, with a hock joint. Toes reduced in number, the third largest. Hind limb with knee enclosed in integument of body; femur with third trochanter; tibia with spine. Astragalus with pulley-shaped articular face for tibia and anterior prolongation. Fore limb with ulna reduced, its carpal surface smaller than that of the radius, which supports the foot in front of the ulna.

Artiodactyla.

Feet digitigrade or unguligrade. Toes reduced, the third and fourth principally and equally developed. Hind limb with knee applied to the side of the body, and elevated hock; femur without third trochanter;

* These characters have been mostly given by Prof. Gill, l. c.

tibia with large spine. Astragalus with both inferior and anterior pulley-shaped surfaces. Ulna much reduced distally, behind the radius, which includes almost the whole of the carpal articulation.

This arrangement violates previous views less than any other that would recognize the primary characters of the *Eobasileus*. The difficulty of determining the limits of the two first named orders, is partially caused by the fact that the *Hyracoidea* present the radius of the *Proboscidia* with the hind foot of the *Perissodactyla*. These animals are, however, well regarded as a distinct order. Whether all the animals to be included in the *Proboscidia* possessed a proboscis or not, is of secondary importance. It is nevertheless highly probable that *Loxolophodon* and *Eobasileus* possessed one, and not unlikely that such forms that approach still nearer the tapirs were not without an organ such as they possess, and which Cuvier ascribed to the *Palæotheria* and other allies.

The divisions of the *Proboscidia* are as follows:

No incisors, nasal bones short; astragalus articulating with navicular only: No third trochanter..... *Proboscidia vera.*

No incisors, nasal bones elongate; astragalus articulating with both navicular and cuboid: No third trochanter..... *Dinocerata.*

Dentition complete; *i. e.* incisors present; ? nasal bones. Astragalus articulating with both navicular and cuboid: A rudimental third trochanter..... *Pantodonta.*

These suborders present a series of approaches to the *Perissodactyla*. Thus the *Dinocerata* agree with the typical *Proboscidia* in addition to the above points, in the posterior expansion of the scapula, and its apical acumination; in the very short cervical vertebræ; in the flat carpal bones; in the absence of pit for round ligament of the femur; in the flattened great trochanter, contracted condyles, and fissure-like intercondylar fossa of the same bone. In the longitudinal crest of the tibia separating glenoid articular faces which are on a transverse line. In the short calcaneum which is wider than long, and tubercular on the inferior face. In the five digits; the acetabulum not separated by a peduncle from the iliac plates, and the lack of angular production of the latter beyond the sacrum. Also in the three distinguished sacral vertebræ, as contrasted with the five closely coössified ones of the *Rhinocerotidæ*. These characters are, some of them, of subordinate value only.

The chief differences are seen in the cranium, though here also there are important resemblances. Thus in *Loxolophodon* the malar bone forms the middle element of the zygomatic arch, sending a narrow strip only forward to the neighborhood of the lachrymal. In *Uintatherium*, according to Marsh, its extension towards the side of the face is rather greater, but still much less than in Perissodactyla. The dentition is not far removed from that of *Dinotherium*, and the mode of succession of the teeth was in all probability similar. The premaxillaries and nasals are

excavated and exostosed for the attachment of a trunk in *Loxolophodon*. The lateral and occipital crests of the cranium, though different from the enlarged sinuses of the diploe of Elephants, represent the external walls of this structure, and furnish a hint as to its mode of origin, and serve to ease the transition to Perissodactyles.

The differences in the cranium are consequent upon its anterior elongation, the nasal bones and premaxillaries becoming thus much extended. The lachrymal is perforated by a small lachrymal canal in *Uintatherium*, according to Marsh, but excavated on the margin only in *Loxolophodon*. It is neither in *Elephas*. There is a postglenoid process more largely developed than in *Proboscidia vera*. Other differences of still less importance are to be seen in the anterior position of the exterior nares, and the presence of horns.

The *Pantodonta* are represented by *Bathmodon*. With a structure of the hinder limb nearly resembling *Eobasileus*, we have more pronounced relationships to the Perissodactyles. The scapula has the massive apical acumination of the *Proboscidia vera*, and there is no round ligament of the femur in some of them. The astragalus has the same flattened form seen in *Uintatherium* and is even less like that of the Perissodactyla. The type of molars and the long compressed canines are similar to those of *Loxolophodon*. On the other hand, the cervical vertebræ are rather longer, and there is a rudimental third trochanter of the femur.

History, etc. I originally referred the *Eobasileidæ* to the *Proboscidia*, on account of the structure of the limbs, and subsequently stated a number of reasons for this conclusion at a meeting of the Academy Natural Sciences of Philadelphia, held January 14th, 1873 (published January 16th). In the present paper, numerous confirmatory characters are added. The *Bathmodontidæ* I have heretofore referred to the *Perissodactyla*.

Prof. Marsh, in describing a species of this group, *Titanotherium ? anceps* (July, 1871), compares it with perissodactyle species, and in describing the tibia says, that it "at its proximal end, has the femoral surfaces contiguous, with no prominent elevation between them, resembling in this respect some of the Proboscidea." A few days before the publication of my conclusions, in a foot-note (July 22d, 1872), he altered the name *Titanotherium* to *Mastodon*, indicating that he had reached the same opinion. Shortly after (Amer. Journ. Sci. Arts, Sept. 27th), he altered his view, constructing a supposed new order "*Dinocerata*," for their reception.

As regards the name of the order here defined as including the three suborders above mentioned, I have preferred using one already employed to coining a new one. This is the better course also, if, as is not unlikely, the distinctions on which it, as well as the other two orders repose, shall be broken down by new discoveries in palæontology.

Dinocerata.

The genera of this group known to the writer are four, which differ as follow:

1. Nasal bones with flat horizontal horn-cores overhanging their apex.
Cervical vertebræ short; malar bone much reduced in front.....*Loxolophodon.*
2. Nasal bones with small tuberosities.
Cervical vertebræ short.....*Eobasileus.*
Cervical vertebræ longer; the malar bone reaching maxillary face.....*Uintatherium.*
3. Nasal bones without the anterior horn-cores.
Cervicals?.....*Megaceratops.*

The dentition of this group requires special notice. Judging from the relative sizes of the teeth, I have written the molar series of *Loxolophodon* 4—2, but judging from the forms of the crowns, it should be 1—5. However this should be, I have no doubt that as in other *Proboscidia* the premolar and not the molar series is deficient, and that there are three or four true molars at least. In a mandible found alone, which agrees in size with some species of *Uintatherium*, six molars are preserved. Of these the posterior two display three sub-transverse crests, of which the anterior two form a chevron with open apex directed to the inside. Anterior to the front crest is a cingular tubercle. The symphyseal part of the jaw is remarkable: it is coössified, exceedingly compressed, and curved upwards so as to resemble slightly the narrow prow of a South Sea boat. There are two teeth on each side, which are separated from the molars by a diastema. They are much compressed and curved upwards and forwards, and the anterior pair issue from the jaw in contact. The crowns are lost in the specimen. The determination of these teeth is facilitated by the presence of the mental foramen below the posterior one. This foramen issues, as is well known, posterior to the canines in all *mammalia*, and either below premolars, or the diastema. The two teeth in our fossil will then be premolar and canine respectively, and the incisors must be regarded as wanting. This is in conformity with the structure of the upper jaw, and is rendered probable by the great reduction of the symphysis of the lower jaw in the species. It is also suggested by the almost universal tendency to reduction of the incisors seen in the mammals of the same extinct fauna. In *Bathmodon* and *Palæosyops* the canines are thrown into the incisor series as in *Ruminantia*, and in *Palæosyops* the outer incisors are much reduced. In several genera there are but two incisors. Finally in *Synoplotherium*, and probably in *Anchiphodus*, the large inferior teeth described by Dr. Leidy and myself as incisors and which resemble the cutters of *Rodentia*, are immediately in front of the mental foramen, and bear the same relation to it and to the premolar teeth, as do the canines of *Palæosyops* and other mammalia. Hence I believe these to be canines, and that the inferior incisors are

wanting. The probability of the truth of this determination is increased by the presence of a small interval between them, and by the fact that they oppose the canines of the upper jaw.

LOXOLOPHODON. Cope.

Proceedings American Philosophical Society, 1872, p. 580, extra copies published August 19th; and p. 488 (Aug. 22d).

The cranium in this genus is very elongate and compressed. The muzzle is posteriorly roof-shaped, but is anteriorly concave and flattened out into a bi-lobed shovel which rises above the extremity of the bone. This extremity is subconic, and short and decurved. A second pair of horn-cores stands above the orbits; each one composed externally of the maxillary bone, and internally of an upward extension of the posterior part of the nasal. Behind this horn the superior margin of the temporal fossa sinks, but rises again at its posterior portion, probably above the level of the middle of the parietal bones. This portion of the skull is injured in my only specimen. The occipital rises in a wall upwards from the foramen magnum, and supports, probably a little in front of the junction with the superior and inferior ridges bounding the temporal fossa, a third horn core on each side. The base of this core is as stout as that above the orbit, and sub-cylindric in section. The temporal fossa has its principal extent posterior to the zygomatic arch, and is in form like a trough, the inferior edge being recurved from the squamosal process to the summit of the occipital crest. It is narrow within the zygomatic arch, which is short, enclosing a space whose length is less than one-fourth that of the cranium.

The occipital bone extends but a short distance on each side of the condyles, and is separated from the mastoid by an irregular suture, which is pierced by a large mastoid foramen. On the inferior face near to each condyle and one-third the distance from its inner extremity, is a posterior condyloid foramen, isolated by a narrow bar from the extremity of the *foramen lacerum posterius*. The paramastoid process is represented by a small tuberosity, and the mastoid by a rather larger one, some distance anterior to it.

The *meatus auditorius* opens upwards just below the external ridge of the temporal fossa and at a little distance behind the post-glenoid process. Its canal contracts rapidly, and extends upwards and backwards towards the labyrinth. It is separated from the *foramen lacerum* by but a thin wall, and if there was an expansion of the *cavum tympani*, it must have been exceedingly small, owing to the close approximation of the mastoid to the basi-occipital and sphenoid at this point. The labyrinth is lodged in a petrous mass opposite the occipito-mastoid suture, and the canals are small.

The *basi-occipital* contracts anteriorly, and with the sphenoid forms an uninterrupted boundary of the *foramen lacerum*. This terminates opposite to the posterior boundary of the external meatus, and gives rise to a

wide shallow groove which extends anteriorly between the pterygoid ala and the postglenoid process, and turning outwards round the latter, grooves it. Opposite to the postglenoid process and just posterior to the end of the pterygoid a small foramen enters, which is probably the *foramen ovale*. Almost continuous with it is a canal which pierces the base of the pterygoid longitudinally, and issues in an excavation of its external face near the sphenoid.

The *pterygoids* are remarkable for their great length, enclosing as they do with the palatine processes, a deep, narrow, trench-like fossa, which measures almost the entire length of the zygomatic fossa. Processes of the sphenoid contribute to these walls (which are thus double), and the sphenoid roof is strongly concave. The *alisphenoid* is elongate anteroposteriorly, and is principally in contact superiorly with the frontal; anteriorly it has a short suture with the lachrymal. Almost its entire length is traversed by a shallow groove which terminates in a small *foramen opticum*, opposite to a point marking the posterior third of the zygomatic fossa. The *foramen rotundum* issues as usual between the alisphenoid and the pterygoid, but is considerably anterior, as well as inferior to the *f. opticum*. I cannot determine whether the orbitosphenoid is distinct.

The *lachrymal* is a large bone of a triangular outline, the shorter side being inferior. It is entirely on the inner face of the orbit, and as in the elephant, separates the frontal and maxillary by its superior prolongation. Its inferior border is slightly notched in front by the large *foramen infraorbitale posterius*, and the anterior is deeply emarginate, passing behind the small *f. lachrymale*.

The palate is remarkable for its length and narrowness. Its roof is chiefly composed of the maxillaries, but a very short portion is formed by the palatine plates of the *o. o. palatina*. These are produced into a median point behind between the nares, and exteriorly form the inner wall of the postnareal trough for a considerable distance. The *maxillaries* also form the outer wall for a short distance, being produced in a contracted form behind the molar teeth. The two bones enclose a small foramen in this prolongation, and a larger one on the anterior suture of the palatine, the *foramen palatinum*. The palate is deeply concave anteriorly. There is an elongate foramen close to the alveolus of the first premolar, extending anterior to it. The premaxillaries are longitudinal and separated anteriorly for two-fifths of their length, by a large *foramen incisivum*, which they do not enclose. They extend on the side of the muzzle into an acute angle upwards and backwards and are prolonged forwards above the exterior nares, which the suture reaches by an abrupt descent. The maxillary supports the malar on a posteriorly directed process which reaches to the end of the anterior third of the arch below, half that distance on the side, and is bordered by a narrow strip of the malar on the inner side, as far as the anterior boundary of the orbit. The *premaxillaries* do not enclose the very large *foramen incisivum* in front, and are therefore deeply furcate.

The *dentition* is I. 0 ; C. 1 ; P. M. 4 ; M. 2. The canine is a tusk of compressed form with anterior and posterior cutting edges, and a strong posterior curvature. Its fang is embraced one-third by the premaxillary bone, and is enclosed in a rib-like swelling of the side of the cranium, which extends upwards and backwards. The premolars are well worn, and have transverse cordate surfaces of attrition. These have probably resulted from the wearing down of a chevron of two crests converging inwards, in some with an inner tubercle. On the molars this crescent is represented by a V, with the apex inwards ; on the last, the inner tubercle is at one side (the posterior) of the apex.

Name.—I first applied the name *Loxolophodon* to this genus in a short paper published August 19, 1872, as above cited, with a diagnostic description ; the *L. cornutus* was there cited as the first species, and is here retained as the type. I again described it more fully in a paper published August 22d, citing *Eobasileus* (August 20th) as a synonym, in which I was in error, as indicated by the present paper. The same nomenclature was employed in a paper read before the American Association for the Advancement of Science, held at Dubuque, commencing August 23, 1872.

In the paper of August 22d, I regarded this genus as identical with that to which I had previously (February 16, 1872) applied the name *Loxolophodon*, and included in it the species there called *Bathmodon* (*Loxolophodon*) *semicinctus*, Cope. With further material this appears not to be correct; the *Bathmodon semicinctus* belongs truly to that genus, and is very near to the *B. radians*, so that the name *Loxolophodon* becomes a synonym in this connection, and may be used again for the present genus without interference.

Loxolophodon cornutus. Cope.

Loxolophodon cornutus, Cope. Proceedings American Philosophical Society, 1872, p. 580 (August 19th), l. c. 1872, p. 488 (August 22d). *Eobasileus cornutus*, Cope, American Naturalist, 1872, p. 774.

Established on the remains of a single individual, which consist of a nearly perfect cranium, the right scapula complete, several vertebræ including the sacral, the first or second rib, the pelvis complete, and the entire right femur ; also probably the proximal end of a radius.

The species is remarkable for the narrow form of the *cranium*, its width at the middle being one-fourth its length. A little in front of the middle, are situated the horn-cores. These diverge, the upper portion having an outward curvature. The base of each is triangular with obtuse angles in section, and the inner angle is the section of a rib-like projection which extends across the middle line to its fellow and rises half way up the horn-core. Above its rather abrupt termination, the core is transversely compressed, with oval obtuse apex. The core measures M. .240 (9.5 inches) from its base in front, M. .108 (4.25 inches) in width at the base behind, and .077 (3 inches) in diameter at the apex. A slight swelling of the sides of the muzzle descends obliquely forwards

from the base of each horn, which enlarges below into a prominent rib, which encloses the alveolus of the canine tusk. In front of the horns the muzzle is roof-like; anteriorly it flattens out, and swells a little above the posterior end of the nasal meatus. In front of this it expands again, and rises gently to the extremity of the bi-lobed nasal shovel, which overhangs the premaxillaries, the nasal meatus and the greater part of the apex of the nasal bones. The latter is short and with a wide base and resembles two lateral cones flattened together, their extremities obliquely truncate outwards and excavated. The composition of the upper surface of the cranium is somewhat difficult to determine, owing to the injured state of the posterior part. If we regard the bone which bounds the lachrymal behind and above, as frontal, as I did in originally describing the species, it gives an extraordinary extent to the nasals, for the common suture of these bones extends V-shaped backwards, to a point opposite to the middle of the zygomatic arches. It gives to the nasals an extent equal to that of the frontals and parietals combined. They not only support the anterior shovels but form the inner half of the median horn-cores, rising as high as the tuberosity above described. To regard these bones as frontals would involve the improbable peculiarity of their extending beyond the nareal orifices, and the terminal cone of the nasals is not separated from them by suture. The question is decided in favor of their being nasals, by those bones as preserved in *Eobasileus pressicornis*, Cope, where the shovel is represented by a tubercle only on the side of a continuous nasal. The immense length of the snout in *Loxolophon* looks as though the nasal bones had extended themselves forward, so as to ossify the basal portions of an elephantine proboscis.

The frontals descend behind the horns, with a very obtuse or rounded continuation, to the inner side of the fossa, and without any superciliary margin. They form with the posterior part of the nasals a shallow median basin. The suture with the parietals is very indistinct, but if I have truly discovered it, it forms another posteriorly directed chevron, and leaves but a narrow superciliary portion of the frontals. Above the postglenoid processes the parietals rise again to the transverse occipital crest, but to what height is uncertain. At the mastoid region, the cranium widens a little, and is excavated at the sides by the temporal fossæ. Near where the lateral and posterior crests join the inferior ridge-like border of the temporal fossa, in front of a position occupied by a knob in *E. pressicornis*, is a strong horn-core with sub-cylindric base. It stands obliquely backwards towards the junction of the inferior squamosal and transverse crests, and is connected to these by an oblique ridge, one side of which is marked with irregular, short, longitudinal rugosities. At the base of these elevations are three sinuses. This portion was found close to the skull, but separated from it, and the precise mode of its attachment has not been discovered by actual fit.

The occiput rises upwards for four inches above the condyles; perhaps it displayed a posteriorly sloping transverse crest as in *E. pressicornis*.

The paramastoid and mastoid tuberosities are narrowed and extend obliquely downwards and forwards. The lower part of the exoccipital suture runs along a ridge, and there is a tuberosity in front of the mastoid foramen. An irregular Λ-shaped crest extends upwards with the apex at the inferior temporal crest, and its anterior limb forming part of the posterior boundary of the *meatus auditorius*. The inferior temporal crest is directed outwards below, but forwards above.

The narrowness of the cranium is readily seen on comparing the postglenoid processes. These are not deep, but have considerable transverse extent, and are separated by a space only a little greater than the transverse diameter of each. The zygomatic arches are compressed posteriorly with crest-like superior ridge, but rounded above anteriorly. There is not the least trace of posterior boundary of the orbit. The squamosal process overlaps the malar bone extensively, terminating in a point, the latter ending obtusely. The malar is supported in front by a maxillary process, which is united with it by a zigzag suture on the outer face and a squamosal one within and below. The *foramen infraorbitale exterius* is large, and issues a short distance in front of the orbit, not so near it as in the elephants. From this point to the ridge enclosing the canine alveolus the side of the maxillary bone is deeply concave, and the palatal surface correspondingly contracted. The bone is continued upwards and outwards as the external part and apex of the middle horn-cores. Anteriorly it is bounded by the premaxillary to a point as far anterior to the base of the horn as the width of the latter; behind that point it is in contact with the nasals. The premaxillary is prolonged upwards and backwards into a narrow tongue. Its inferior portion is convex above on each side, concave below, with projecting alveolar borders, which are flat and slightly concave fore and aft. The extremity of each is rugose below, supports a prominent tubercle medially and a smaller one at the superior angle.

The exterior nares are not separated by osseous septum. Their lateral border is marked on the inferior surface of the nasal and premaxillary roof, by a curved ridge or crest, which converge forwards and bound the interior concavity of the roof. They gave support to muscular or ligamentous attachments. The posterior angle of the nares is abruptly excavated with thickened walls. The palate is remarkably narrow, and is most deeply excavated between the alveolæ of the tusks, or at the maxillo-premaxillary suture. From near this point to the palatine suture a low but sharp crest extends along the middle line. The width of the palate at the diastema is one ninth of its length. The diastema is more than half the length of the molar series. The pterygoid process of the palate has two convergent grooves on its inferior surface.

The *teeth* are remarkable for the extent of the exposure of their slender roots, as well as their very small size as compared with the size of the animal. The tusk is slightly turned outwards at the tip and the inner face is worn by attrition with some opposing tooth for one-third its length

on the posterior third. The superior margin of the enamel on this side is chevron-shaped, the apex being only one-third the length from the extremity. It extends further upwards in front and on the outer side, but is worn in an oval patch at the apex of the chevron of this side by contact with the inferior teeth, as above described. The enamel is smooth behind, rugose in front. The apex contracts regularly to a flattened obtuse point. The fang is hollow for about half its length. The enamel of the molars is nearly smooth. Each one has a strong cingulum fore and aft, which is discontinued on the inner and outer faces except in P. M. 1, and M. 2. In the former, it is continued on the outer side at the base of the concavity of the exterior face; on the latter, it is continued round the inner side. The grinding surface of the P. M. 1, is tripodal, and probably composed of a worn crescent and inner tubercle. The others are transverse arrow-shaped; the P. M. 4 is much more worn than the others. M. 2 is larger than M. 1. Its oblique crests have evidently been worn from before. All the molars have three roots, but the posterior pair are united for part of their length in all.

The *vomer* does not unite with the superior crest of the palatine bones. The sphenoid flattens out behind the post-nareal trough and is coösified with the basioccipital. The latter is marked by two oval surfaces at the place of suture, with a slight prominence between. No lower jaw was found with this specimen, but from the contraction of the parts opposed to it, it was evidently very small.

Cranial Measurements.

	M.
Length from end nasals to end occipital condyle (3 feet 1.5 inches)	0.930
Width just behind end nasal shovels	.192
" in front of horns	.132
" at base of horns in front	.205
" behind horns at apex of frontal suture	.185
" above posterior edge *meatus auditorius*	.310
" between apices horn-cores	.370
" basis supraoccipital horn-core	.100
" including zygomatic arches (greatest)	.320
Length of nasal bones to ridge between horn-cores	.410
" " " " " frontal suture	.540
" of zygomatic fossa above	.230
" from angle nares to end shovel	.205
" " " " " " premaxillary	.155
" from end premaxillary to basis of canine	.120
" " " " " " P. M. 1	.276
" of molar series	.185
" of palate	.450
" of pterygo-palatine crest	.200
" of sphenoid axis	.185
" " basioccipital (with condyles)	.128

	M.
Width between tips premaxillaries	.070
" at canine alveoli	.185
" between canine alveoli	.080
" at diastema	.050
" between last molars	·070
" " pterygo-palatine crests	.065
" of postglenoid process	.095
" between postglenoid processes	.095
" basioccipital at front	.073
" " " condyles	.200
" of space for lymphanic chamber	.034
Length tusk on curve (12.7 inches)	.320
Diameter at middle (antero-posterior)	.050
" " base " "	.063
" " middle (transverse)	.030
" " crown P. M. 1 transverse	.022
" " " antero-posterior	.024
" " M. 1 " "	.035
" " " transverse	.034
" " M. 2 "	.043
" " " antero-posterior	.045
Elevation of shovel above base of apex of nasal	.060

The measurements may require some correction in respect to the supraorbital width, where the cranial walls have suffered from compression. The frontal of one side has been pushed so as to overlap that of the other by about an inch.

The *scapula* is of a sub-triangular form, the front being vertical, the apex directed backwards and an angle upwards. The posterior expansion is considerable, as in the elephants, while the superior angle is acuminate and much produced and massive. The spine is much elevated, bounding a deep supraspinous fossa. It is truncate in front descending to near the border of the glenoid cavity. Its extremity is dilated in alate fashion, equally fore and aft, and not posteriorly only as in the elephants. The glenoid cavity is flattened so as to be longitudinal, and the coracoid is a rudimental tuberosity.

Measurements of Scapula.

	M.
Total length (25.25 inches)	0.640
" width	.480
Length apex from spine	.140
Elevation of spine proximally	.125
Length of glenoid cavity	.185
Width " " "	.110

The interior side of the scapula is strongly convex by the development

of two longitudinal ribs, one corresponding to each fossa, but concave in longitudinal section.

The proximal end of the *radius* exhibits two facets oblique to each other, the larger concave and transverse, the other oblique downwards. Transverse width M. 0.130; vertical .070. The extremity of a humerus not found with this individual, to which the radius applies pretty well, has a very oblique trochlear face, and measures seven inches across the condyles. It, however, belongs to a smaller species.

The *femur* is entire. Like that of other species of the group it is much expanded proximally and deep distally, with the shaft contracted and somewhat flattened in the plane of the great trochanter. The latter is in one plane, with its external margin turned a little backwards. The head is part of a globe, and is a little more elevated than the trochanter, and separated from its apex by a shallow concavity. There is no little trochanter. The trochlear face is not elevated nor wide, and with lateral borders subequally developed. The antero-posterior axis of the condyles is somewhat oblique to a line at right angles to the proximal end. On this account the interior condyle is the longer; its articular face is continuous with the trochlear, with a marginal notch; the outer condyle is continuous, with continuous outer margin. Strong ridges revolve from above the condyles to the posterior face of the shaft, the inner near the condyle. The outer runs parallel to the main axis as a low external ala, and backwards three inches above the condyle. The face between them is concave.

Measurements of Femur.

	M.
Total length, (31.75 in.)	0.747
Total proximal width	.255
Diameter of ball	.136
Transverse diameter at middle of shaft	.096
Antero-posterior " " "	.074
" " condyles posteriorly	.150
Transverse " " "	.160
" " " distally	.145

The *pelvis* has a large transverse expansion. The iliac plates are ovoid in outline, with the apex outwards and downwards. The margins are rather thin excepting the internal above the acetabulum. These are massive, and with a longitudinal excavation. They terminate in a deep oblique excavation for the diapophyses of the sacrum. The external margin rises compressed from just above the acetabulum. The latter is large for the size of the ilia, and its margins rise to a slight elevation beneath the exterior margins of the latter. The *incisura acetabuli* is obclavate, and nearly symmetrical. The *os ischium* is compressed and deeper than the pubis. It possesses a tuberosity on the posterior inferior margin. The *obturator foramen* is small and is a vertical oval. The *pubis* is rather slender and short. Its section at base is subtriangular; beyond,

it becomes more compressed, and is spirally twisted on itself through part of a circle. Its anterior margin near the symphysis is strongly rugose for the origin of the *pectineus* muscle; the rugosity extends into a band on the outside of its proximal portion.

Measurements of Pelvis.

	M.
Long diamater of ilium	0.605
Transverse do. at acetabulum	.430
Length inferior free margin do	.250
Long diameter acetabulum	.150
Shorter " "	.130
" " obturator foramen	.070
Width ischium at tuberosity	.140
Length " to "	.110
Diameter pubis at obturator foramen	.062
Expanse of ilia laid on a flat surface and with sacrum in place (4.2 ft.)	1.280

The general character of the pelvis is more like that of the Elephant than that of any Perissodactyle. It agrees with the former and differs from that of the *Rhinocerus* in the shortness of the pedestals of the ilia or rather in the sessile position of the latter on the acetabula; also in the absence of production of the iliac crests in advance of and above the sacrum. It is also elephantine in the shortness of the inferior elements of the pelvis.

Of *vertebræ*, there are preserved a dorsal, two lumbar, and some sacral. The first is very short and transverse. It is so injured that I can only give measurements. The base of the transverse neurapophysis is a flat oval; both capitular articular surfaces are deep. The anterior lumbar is longer, but still short; its articular faces are slightly concave. The neural arch is wide, and supports the diapophysis. The sides of the centrum are concave and pierced by foramina, and there is a strong rugose hypapophysis. The section at the middle is subtriangular. I have three sacral vertebræ which are separated by very distinct sutures. They diminish very rapidly in size, and the centra become flattened transverse. It is doubtful whether there was a fourth vertebra, and the tail must have been short and slender. The articular face of the first is a transverse rather broad ellipse and twice the diameter of the third distally. The diapophysis of the second is much the stoutest. It unites with the subvertical plate-like diapophysis of the first as well as with that of the third. It is concave above, and terminates distally in a massive L-shaped surface of articulation with the ilium. The foramina enclosed by the diapophyses are quite large. The inferior face of the first sacral centrum is slightly concave with a hypapophysial tuberosity in front; it is strongly concave in the second.

Measurements of Vertebræ.

	M.
Antero-posterior diameter of dorsal	0.044
Diameter at bottom neural arch do	.040
Length base of neurapophysis	.041
Diameter centrum lumbar (vertical)	.090
" " " (transverse)	.110
" " " (antero-posterior)	.080
Length three sacral vertebræ	.226
Transverse extent of sacrum (15 in.)	.380
Diameter first vertebra at free end (transverse) (4.6 in.)	.122
" " " " (vertical)	.093
" last " " "	.021
" " " " (transverse)	.065
Total expanse of heads of rib	.106
Diameter capitular face (vertical)	.048
" tubercular "	.030
Width rib just below head	.050

Restoration. We may ascribe to the *Loxolophodon cornutus*, form and proportions of body similar to those of the elephant. The limbs, however, were somewhat shorter, as the femur is stouter for its length than in the *E. indicus*. It was intermediate in this respect between the latter species and the species of *Rhinocerus*. The tail was quite small. The neck was a little longer than in the elephants, but much less than in the rhinoceroses; the occipital crest gave attachments to the *ligamentum nuchæ* and muscles of the neck, which must needs have been powerful to support the long muzzle with its osseous prominences, and to handle with effect the terrible laniary tusks. The head must have been supported somewhat obliquely downwards, presenting the horns somewhat forwards as well as upwards. The third or posterior pair of horns towered above the middle ones, extending vertically with a divergence, when the head was at rest. The posterior and middle pair of horns were no doubt covered by integument in some shape, but whether dermal or corneous is uncertain. Their penetrating foramina are smaller than in the *Bovidæ* The cores have somewhat the form of those of the *Antilocapra americana*, whence I suspect that the horns had an inner process, or were palmate as in the prong-horn at present inhabiting the same region. The nasal shovels may have supported a pair of flat divergent dermal horns, but this is uncertain; they are not very rugose.

The elevation of the animal at the rump was about six feet, distributed as follows:

	Inches.
Foot	4.50
Tibia	20.50
Femur	31.75
Pelvis	16.
	72.75

The anterior limb was stouter than the posterior, judging from the proportions in *Eobasileus pressicornis*, and were no doubt more elevated, if of the Proboscidian character. This would give us the hypothetical elevation at the withers:

	Inches.
Leg	61.00
Scapula (actual)	21.00
Neural spines (extremities)	7.00
Or seven feet, five inches	89.00

These measurements are made from the plantar and palmar surfaces, allowance being made for the pads.

The neck, estimating from the dorsal vertebræ and from the cervicals of other species preserved, could not have exceeded one foot in length, and may have been less. This added to the length of the cranium, gives a total of about four feet. The obliquity of the antero-posterior axis of the cervical vertebræ, indicates that the head was posteriorly elevated above the axis of the dorsal vertebræ. Thus it is entirely clear, that the muzzle of this animal could not have reached the ground by several feet, and that, as occurs in the similar cases of the Tapirs and Elephants there was a proboscis to supply that necessity. The indications derived from the bones of the muzzle confirm this conclusion, as has been already pointed out. There could have been no interference from the horns near the ends of the nasal bones, for the bases of these project beyond the origin of a proboscis, and were directed outwards while the latter hung downwards.

This species was probably quite as large as the Indian Elephant, for the individual described is not adult, as indicated by the freedom of the epiphyses of the lumbar vertebræ, and fragments of others in my possession indicate considerably larger size.

Habits. The very weak dentition indicates soft food, no doubt of a vegetable character, of what particular kind it is not easy to divine. The long canines were no doubt for defense chiefly, and may have been useful in pulling and cutting vines and branches of the forest. The horns furnished formidable weapons of defense. That the anterior nasal pair were not used for rooting in the earth is evident from the elevation of the head, which would render this impossible.

This huge animal must have been of defective vision, for the orbits have no distinctive outline, and the eyes were so overhung by the horns and cranial walls as to have been able to see but little upwards. The muzzle and cranial crests have obstructed the view both forwards and backwards, so that this beast probably resembled the *Rhinoceros* in the ease with which it might have been avoided when in pursuit.

Locality. The remains of the *Loxolophodon cornutus* were found by the writer in August, 1872, in a ravine of the bad lands of Wyoming. The greater part of the cranium and the femur were excavated from the base of a cliff of perhaps 250 feet in height, on the side of a ravine elevated

about 1000 feet, in the Mammoth Buttes, on South Bitter Creek. As the basin of Bitter Creek is 7,500 feet above the sea, the fossil was taken from an elevation of 8,500 feet. The horizon is the Bridger Group of the Eocene of Hayden.

EOBASILEUS. Cope.

Proceedings of the American Philosophical Society, 1872, p. 485 (Extra copies published by the author, August 20th).

As pointed out above, this genus resembles *Loxolophodon* in the very short cervical vertebræ, but agrees with *Uintatherium* in the rudimental condition of the nasal horn-cores, which are mere tubercles. The posterior or third pair of horn-cores are also very different, and probably stand on the largely developed lateral crests of the superior surface of the cranium, as in *Uintatherium*. They are apparently preserved in *E. furcatum* (which is not the type of the genus), and are compressed from base to summit; in *Loxolophodon* the base is nearly cylindric.

The characters of this genus had not been indicated in any of the descriptions published by palæontologists prior to its establishment as above cited. It is possible that *Tinoceras grandis* of Marsh may be synonymous with one of the species here referred to it, but this point cannot be determined from the descriptions of that author.

The cervical *vertebræ* in *E. pressicornis* are very short. The limbs are much as in *Loxolophodon*, as are the scapula and pelvis. The *symphysis pubis* of *E. pressicornis*, or an ally, is short, and was separated from the ischiadic symphysis, but whether this belongs to the genus is not entirely certain.

The *navicular* bone, of perhaps the same species as the above, displays, as in living proboscidians, four inferior facets, thus proving the existence of five toes to the hind foot. The external facet is deeply concave, and contains a pit. It is oblique, and unites with the superior face by an acute angle. It supported the small inner toe by its metatarsus directly. The other three are more nearly on one plane, and are deeper than wide. The navicular is in form a little less than a quarter of a circle, and the external (anterior) depth is one half its transverse length. Its superior surface is slightly convex.

Eobasileus pressicornis. Cope.

Loxolophodon pressicornis, Cope. Proceed. Amer. Philos. Soc., 1872, p. 580 (published by the author, August 19th). Loc. cit., p. 488 (August 22). *Eobasileus cornutus*, Cope, l. c., p. 485 (Aug. 20th), not *Loxolophodon cornutus*, Cope, l. c., Aug. 19.

Represented by numerous portions of the cranium, with fragments of limbs of one individual; of almost all portions of the skeleton except the cranium, of a second. A humerus with astragalus of a third are of uncertain reference, while a single humerus of another species may belong here. Fragments of several other individuals of appropriate size may pertain to it.

The *cranium* is represented by nasal, maxillary, malar, occipital bones, etc. The first named has a half conic apex, and an oblique compressed tuberosity, which forms the lateral border behind it, and is directed obliquely upwards. The apex of each nasal is vertically compressed acute and is deeply pitted and rugose for muscular or ligamentous attachments. The inferior lateral marginal ridge is contracted, and encloses a concave median space. The tuberosity sinks to the level of the median suture. The posterior part of the nasal rises to the apex of the middle horn-core, forming its inner face. The postero-superior angle of the premaxillary reaches to near the base of the horn, and is not drawn out to a narrow apex as in *L. cornutus*. The horn is compressed antero-posteriorly at the base; at the apex obliquely inwards and forwards. The outer face is concave on the lower half, the inner convex. The posterior face is concave and the anterior convex when viewed from the side.

Measurements of Nasal Bone.

	M.
Width of both at tuberosity	0.124
" " base of distal cone	.060
Depth of suture at front of tuberosity	.030
Length of suture from premaxillary to horn-core	.035
" horn-core (in front) (6 in.)	.150
Diameter (externally)	.080
" of apex	.048

The occipital region is furnished with an enormous transverse crest which extends upwards and backwards. Its margin is gently convex, and its supero-anterior face concave. The posterior is narrowed by the inferior crest-like margins of the temporal fossa which extend from the squamosal part of the zygoma and gradually contract, terminating abruptly in a low knob where it joins the transverse crest. The posterior face between the former is divided into two planes by a low vertical ridge, which terminates some distance below the summit. The transverse crest is continued in a curve forwards on each side as the superior margin of the temporal fossa. The specimen does not indicate whether these supported horns, but they are very stout.

Measurements of Occiput.

	M.
Elevation from *foramen magnum*	0.180
Width between inferior temporal crests	.250
" of condyles with foramen	.180
Elevation above internal sinuses at angles	.180

The mastoid tuberosity is short and stout; the mastoid foramen is large and not piercing a crest. The ex-occipital suture is obliterated. The A-shaped crest behind the meatus in *Loxolophodon cornutus* is little marked here. The surface of the bone has various muscular impressions. The basi-occipital exhibits a low median crest dividing lateral concavities:

transverse width at condyles .077 M. The fragments of teeth are too uncharacteristic for specific description. Numerous cranial fragments accompany the above, but have not yet been properly placed.

The *atlas* is broken; its cotyloid cavities are rather shallow, and the diapophyses small. Its antero-posterior diameter below at the middle line is .070; at base of diapophysis .070. The condyles of the *femur* present the characters of the group. There is a deep vertical groove on the inner side just above the condyle. The latter approach each other closely on each side of the intercondylar fossa and are flattened on the superior posterior margins. Width across extremities M. .150.

At a distance of one or two hundred feet from the above specimen I found portions of the skeleton of a smaller animal, probably a different but allied species. It is represented by portions of ribs and limbs, of which the ulna is described under *Uintatherium*. Two or three hundred yards from the typical specimen, I obtained remains of almost all parts of the skeleton of what is probably the present species. The femur is identical in character. The specimen embraces cervical dorsal and lumbar vertebræ, ulna, both femora and tibiæ, astralagus, navicular, etc., and large parts of the scapulæ and pelvis.

The *scapula* in its proximal portions, differs little from that of *Loxolophodon cornutus* besides in inferior size. The coracoid is a compressed tubercle enclosing a groove with the glenoid cavity.

	M.
Diameter glenoid cavity (longitudinal)	0.168
" " " (transverse)	.098

The *os pubis* displays a strong pectineal rugosity commencing near the acetabulum.

	M.
Long Diameter of acetabulum	0.143
Length ischio pubic suture	.108
Diameter pubis near acetabulum	.052

The *femur* is nearly as long as that of *Loxolophodon cornutus*, but is more slender, and has a relatively smaller head. It is flattened fore and aft, and the great trochanter is much expanded and with a shallow concavity on the posterior face. There is a marked concavity on the posterior face of the shaft above the condyles. There is a rudiment of the little trochanter. The *tibia* is scarcely three-fourths the length of the femur, and has a rather contracted shaft, which is in section rounded triangular, one angle presenting forwards. There is no spine except a rudiment in the swollen upper portion of the anterior ridge. The articular surfaces are together rather narrowly transverse. They are separated by a keel which is undivided posteriorly; anteriorly the contiguous margins of the cotyli separate. The long axis of the inner of these is directed antero-posteriorly outwards in front; of the other similar but much more transverse. It overhangs the shaft outwards and backwards and supports beneath, the subround down-looking fibular articular surface. The distal articu-

lar surface is distinguished from allied species by the downward prominence of the malleolar process, the antero-posterior width, and the greater extent of the fibular articular face. The face is slightly concave antero-posteriorly and openly sigmoidal transversely.

Measurements of Leg.

	M.
Length with astragalus in place	1.200
Femur, length	.750
" diameter ball	.118
" width at great trochanter	.220
" " " middle shaft	.091
" depth " "	.060
Tibia, length	.470
" width proximal surfaces (transverse)	.147
" " " (antero-posterior)	.070
" transverse diameter shaft	.061
" antero-posterior "	.065
" " " distal articulation	.092
" transverse " " "	.121
Fibula, length	.430
" transverse width at middle	.032
" width proximal articular face	.042
" " malleolar " " (transverse)	.052
" " " " " (longitudinal)	.044

A section of the fibula, near the proximal end, is sub-triangular; a short distance below, sub-circular; on the distal two-thirds it is flat, with the thinner edge convex inwards.

The *astragalus* is a flat bone, with its entire superior face occupied by the tibial articular surface. This is as broad as long, and very little convex. It is broader in front than behind; the outer margin is concave, the inner slightly convex. The posterior margin projects most on the outer side, and it is divided by a pit-like cavity, which sends a groove to the inner margin. The outer malleolar surface is an antero-posterior oval; the inner, a concavity, beyond which the inferior portion of the bone projects. The inferior face is divided by a prominent transverse angle, between sub-anterior and sub-posterior faces. The latter receives the calcaneum on two oval surfaces, which are joined behind by a narrow strip. The navicular face is sub-rhomboid, the cuboid one-third as large, and triangular, with a round base outwards. The margin of the former scarcely projects beyond the superior face.

Measurements of Astragalus.

	M.
Total width	0.128
" length	.107
Width tibial face in front	.090

	M.
Length tibial face externally	.088
" internal malleolar face	.045
" outer calcaneal do. antero-posteriorly	.050
Length navicular facet	.095
Width do. (antero-posterior)	.060
Length cuboid facet	.065
Width do. (antero-posterior)	.035

A *navicular* belonging to the individual mentioned first has been already described.

Measurements of Navicular.

	M.
Depth in front	.048
Width (transverse)	.097
" of external facet	.035
" " second	.026
" " third	.047
" " internal	.023

A distal end of a humerus was found with two astragali about a hundred yards from the last individual. The articular face is very oblique to the transverse axis, but is about equally developed on opposite sides of the shaft. The condyles are unequal, have parallel axes, and are separated by but a shallow concavity. The fossæ of opposite sides are not very large nor deep.

Measurements of Humerus.

	M.
Transverse diameter distally	.175
Do. of inner condyle	.104
" outer "	.125
Transverse diameter olecranon	.110

The portion of *ulna* just measured belongs to the individual of which so many fragments were found, or No. 2.

The dorsal *vertebræ* of the same are somewhat distorted by pressure; I will therefore describe a cervical of natural form. The centrum is very short, and the articular face is a wide, transverse oval. Both are slightly concave, and the axis being slightly oblique, the anterior is the more elevated. The surface of the latter is quite rugose, except on the margins. The cervical canal is wide, and the neur- and parapophyses narrow. Inferior surface regularly convex.

Measurements of Cervical Vertebra.

	M.
Length centrum	.044
" basis neurapophysis	.040
" anterior articular face	.102
Depth " "	.086
Width neural canal at base	.060

Restoration. The elevation of this animal was not much less than that of the *Loxolophodon cornutus*, but the proportions were more slender. As in all the species of *Uintatherium* in which the horns are known, these appendages stood in front of the orbits, and nearer the nareal opening than in the type of the former genus. The muzzle, too, is materially shorter and more contracted, and the true apex of the muzzle was not overhung by the great cornices seen in *Loxolophodon*. The horn-sheaths were probably simple, while in *L. cornutus* they were probably palmate. The occipital and parietal crests are much more extended in this species than in the *L. cornutus*, so that in life the snout and muzzle had not such a preponderance of proportion as in that species. All the species of this genus were rather more rhinocerotic in the proportions of the head, although the horns and tusks produced a very different physiognomy. The extremities of the nasal bones, though not excavated as in that species, are strongly pitted and exostosed, and this taken in connection with the elevation of the head renders it probable that this species also possessed a proboscis.

History. This species was originally described by the writer in a short paper, which was published and distributed August 19th, 1872, under the generic name *Loxolophodon*. I shortly afterwards referred it to the new genus *Eobasileus*, under the name *cornutus*, under the impression that it was the same as the *Loxolophodon cornutus;* but finding this was not the case, I again used the specific name here adopted. More than a month later Prof. Marsh (September 21st) described a species under the name of *Tinoceras grandis*, which agrees with this one so far as relates to the length of horn-cores, but that it is the same species cannot now be positively asserted. I originally (August 20th, 1872) alluded to the horn-cores as situated on the frontal bones; Marsh has since asserted them to be composed of the maxillaries. I have discovered on the first opportunity of making a detailed examination, that the inner face is composed of the posterior part of the nasal bones, and the exterior of the maxillaries.

Eobasileus furcatus. Cope.

Loxolophodon bifurcatus, Cope, in extra copies on Proboscidians of the Eocene of Wyoming, mailed by the author, August 19th 1872.* *Loxolophodon furcatus* in the same, Proceedings American Philosophical Society, 1872, p. 580, September 20th. L. c. 488, August 22d.

This species was originally described from a large horn-core whose extremital part resembles strongly the nasal shovel of *Eobasileus cornutus*, on which account I referred it to that position on the skull. Marsh has described somewhat similar horn-cores from the lateral crests of the skull behind in *U. mirabile*, whence it may be that my specimen is referable to that position, although it differs much from those of that species.

* See Proceedings American Philosophical Society, 1872, p. 515, where this name is recorded.

The basis is very narrow and lenticular; a short distance above it the outer side is convex. The anterior and posterior extensions of the base differ; the one is thinner, the other more massive and with a shallow groove above its commencement. The latter may be posterior. If so, the compressed apex of the horn-core sends down a rib outwardly to the anteriorly and one inwardly, which disappears on the convex base. The general form is spatulate with the apex expanded obliquely across the lateral crest, and regularly rounded in superior outline. Its anterior face is flat, the posterior convex; its surface is grooved by very small blood vessels.

As compared with the posterior horn-core of *Loxolophodon cornutus*, there is every difference. That is continuous with one margin of the crest; this, erect above it; that has a round base, this a lenticular one. It is more like that of *U. mirabile*, which I only know from Marsh's figure, but abundantly distinct. It is much more elongate, especially above the posterior? part of the crest, and is flattened, and without the triangular section of that species.

Measurements of Horn-core.

	M.
The total length above crest (5.5 inches)	0.135
" " " " base ($7\frac{1}{4}$ inches)	.180
Width across apex (in front)	.095
Thickness across apex (in front)	.028
" at base	.040

It is not certain that this horn may not belong to the *E. pressicornis*, if it be a posterior core, of which, however, I am not yet entirely sure. In that case the name *furcatus*, under which it was first described, becomes a synonym of *E. pressicornis*.

UINTATHERIUM. Leidy.

Proceedings Academy Natural Sciences, Philadelphia, 1872, page 169 (published early in August). *Dinoceras*, Marsh, Amer. Journ. Sci. Arts, 1872. October, 1872 (published September 27).

This genus resembles the last in its general proportions, but differs in its more elongate cervical vertebræ. The centra of these are flat at both extremities, but have not such a marked elephantine abbreviation as seen in the two genera above described. This enabled the head to approach the ground more nearly, and as the limbs were shorter in some of the species, they no doubt modified the length of the proboscis, if present.

Several names have been applied to this genus. Professor Leidy's name here employed, bears date early in August, but of the precise day I am not informed. Professor Marsh, in the Am. Jour. Sci. and Arts, 1872 (Sept. 21st), applied the name *Tinoceras* to a species (*T. grandis*) perhaps of this genus, and gave a description in which some of the

generic characters may have been mentioned. He had previously applied it without description to the *Uintatherium anceps*, Aug. 24th (and 19th*, in an erratum, where *Mastodon anceps* is altered into *Tinoceras anceps*). As no characters whatever were assigned to it on either of these occasions, it had no value in zoölogical nomenclature, and must bear date September 21st. Under date of September 27th, Prof. Marsh proposed the name *Dinoceras* (American Journal Science Arts, 1872) for the *U. mirabile*, but did not give his reasons for separating it from his former genus (the names of the two bear an objectionable resemblance), or those published by Dr. Leidy, or myself. Until such reasons be adduced, I retain it also in *Uintatherium*, as is done by Dr. Leidy.

I am acquainted, by autopsy, with two species of this genus. None of them are so large as the *Eobasileus pressicornis; U. robustum*, Leidy, is smaller, and the *U. lacustre*, Marsh, smaller still. *U. mirabile* (*Dinoceras*, Marsh) is about the size of the *U. robustum*, and nearly allied to it; but it may be distinct, as it has a larger mastoid process. *Tinoceras grandis*, Marsh, agrees in measurements with the *E. pressicornis*, and is perhaps that species or the *E. furcatus*. The *Tinoceras anceps*, Marsh, has been so imperfectly characterized as to be practically unknown. It is one of the smaller species, and is most likely to be identical with the *U. robustum*, whose name it antedates. Until these points be cleared up, I retain three species, as follows: *Uintatherium robustum*, Leidy; *U. mirabile*, Marsh; *U. lacustre*, Marsh. For convenience I compare these species with those of *Eobasileus*.

The naso-maxillary horn-cores have been seen in *E. pressicornis* and *U. mirabile*, and the nasal tubercles in the same. The posterior horn-cores are known in the *U. mirabile*. The posterior and lateral crests of the cranium inclose a basin-shaped concavity above in all these species; it has been observed in all but *E. furcatus*. The dentition is similar to that in *Loxolophodon*, *i.e.*, I. 0; C. 1; P. M. 4; M. 2. The first premolar in *U. lacustre* has an internal cone and outer concave crest. The worn surfaces of the other teeth in that species, *U. robustum* and *U. mirabile*, are narrow ovate, with a deep exterior emargination. The true molars support two crests, which converge inwards and unite with a small tubercle behind the apex in *U. lacustre* and *U. robustum*. The tusk is long, compressed and double-edged, as in *Loxolophodon*. The last inferior molar in *U. robustum* possesses three transverse crests, the posterior two parallel, and obliquely directed inwards towards the axis of the anterior, which is the highest.

In a specimen of one of the smaller species, the *ulna* widens considerably distally, being nearly as wide as the olecranon. The latter is large, flattened and subtransverse, and presents a sharp ridge internally. On the inner side of the distal part of the articular face for the humerus is a tubercle, from which a short, wide groove runs out on the inner face of

* These papers were not received by me till early in December, 1872.

the bone, the head of the radius is a little exterior to the middle line, and the shaft crosses the ulna in an open, shallow groove to the inner side.

The *cuboid* is flat, and displays two proximal and two distal articular facets in *U. furcatum*. The astragalus of the same species is subbifurcate posteriorly, and has internally an extensive, oblique malleolar fossa. The *calcaneum* is short and massive, with two superior and one small anterior articular facet.

The species may be thus distinguished :

1. Large species (occipital condyles extending over about M. 0.170.)
Naso-maxillary horns long ; tibia with wide articular faces..... *E. pressicornis.*
Horn-cores flat, elevated..... *E. furcatus.*
2. Species of intermediate size.
A prominent mastoid process, molars smaller..... *U. robustum.*
Mastoid process not prominent; maxillary horn-cores low, triangular; posterior horn-cores short, triangular in section *U. mirabile.*
3. Smallest species (occipital condyles extending over about M. 0 .95.)
Molar teeth larger, the last with a posterior expansion.. *U. lacustre.*

Previous to describing the species I notice a part of the skeleton of a large mammal, second only in bulk to *Loxolophodon* and *Eobasileus* above described.

These, which were not found in association with a cranium, consist of several vertebræ, some carpal bones, the entire hind limb of the left side except the toes and the cuneiform and navicular bones.

The odontoid process is very stout, with a descending trihedral apex. Length M. .078, diameter at base, .048. A dorsal vertebra with a single (anterior) capitular articular face, is quite concave in front.

	M.
Diameter antero-posteriorly.....	.057
" vertically.....	.094

A cervical vertebra has the proportions of the dorsal as to its centrum, thus differing materially from species previously described. The articular surfaces are slightly concave.

	M.
Length (antero-posteriorly).....	0.065
Diameter vertical.....	.087
" transverse.....	.100

The *femur* resembles that of the other species already described, but is remarkable for the relatively small size of the head. While the lengths of the bone are not very different, and the expanse of the great trochanter about the same, the head of *L. cornutus* is large, the present one is very much smaller, and that of *E. pressicornis* intermediate. There is a rudimental third trochanter, and the condyles are as large as, and similar to those of, *E. pressicornis.* The external marginal condylar ridge is quite short. The shaft is broken and some small pieces lost ; it is now 26 inches long, but was no doubt longer when complete.

Measurements of Femur.

	M.
Expanse of great trochanter	0.230
Diameter of head	·109
" " shaft at middle	.093
" above condyles	.152
" at extremity of condyles	.139
" (vertical) of inner condyle	.125

The *tibia* is perfectly preserved. It is short and stout and with massive extremities. The outer basal part of the spine remains and is prominent. The cotyli are not oblique; the inner is subround, the outer transverse, widening outwardly; their long axes are at right angles to each other. The crest is a low ridge of contact of the cotyli. The superior fibular face is a transverse oval; the inferior much smaller than in *E. pressicornis*. The shaft is contracted, and flattened behind and on the inner side. The distal extremity is transverse, less truncated for the fibula than in *E. pressicornis*, less convex behind, and with a less prominent external malleolus. The point dividing the astragalus behind is more prominent.

Measurements of Tibia.

	M.
Total length	0.398
Diameter head longitudinal	.080
" " transverse	.138
" shaft transverse	.063
" " antero-posterior	.060
" distal articulation "	.077
" " " transverse	.113
" " extremity, fore and aft	.093
" " " transverse	.125

These measurements show that this bone is considerably shorter than in *E. pressicornis*, though of equal distal diameters. In both species the measurements considerably exceed those given by Marsh for his *Titanotherium* (?) *anceps*. The form of the articular extremities differs from both in being more narrowed and transverse.

The *fibula* is larger proximally and smaller distally than in *E. pressicornis*. Diameter proximal articular face .039; of the distal .045.

The *astragalus* is similar in size and form to that of *E. pressicornis*, but differs in two points. The posterior margin is deeply incised for the ligamentous insertion, and the outer lobe is clearly cut to this fossa, on the inner side. There is a pit for a ligament on the convexity of the inner part of the middle of the tibial articular face. A third difference is seen on the inferior face. The inner calcaneal facet is longer and narrower, and is margined on the inner side by a large fossa parallel to its axis, which is wanting in the other species. The *calcaneum* is short and wide;

its only anterior articulation is with the cuboid and is small. The heel is deeper than long and is obliquely truncate downwards and inwards.

Measurements of Calcaneum.

	M.
Length	0.105
Width	.092
Depth in front	.056
Length heel	.047
Depth "	.055
Length cuboid facet	.038

The *cuboid* is a flat sub-triangular bone with two unequal articular faces below.

	M.
Length	.064
Width	.076
Depth	.031
Length cuneiform (antero-posterior)	.040
Depth "	.017

A *humerus* of a third specimen may or may not belong to this species. It was found in another locality. Its condyles are much less oblique than in that one described under *E. pressicornis*. It belonged to a larger animal, see

Measurements of Humerus.

	M.
Transverse diameter distally (7.75 in.)	.195
" " inner condyle	.125

The olecranar fossa is shallower.

Remarks.—The remains were discovered by the writer in the Bridger Bad Lands on South Fork of Bitter Creek, Wyoming.

UINTATHERIUM ROBUSTUM. Leidy.

Proceedings Academy Natural Sciences, Philadelphia, 1872, p. 169, August. *Uintamastix atrox*, Leidy, l. c. (? ?) *Titanotherium anceps*, Marsh, American Journ. Sci. Arts, 1871, p. 35.

I have been able to examine, through the kindness of Prof. Leidy, the type of his description, and find it to belong to a smaller species than any of those above described. The lateral parietal and supra-occipital crests are well developed, and the latter extends obliquely backwards. Several peculiarities are to be observed in the dentition. Thus there is great inequality in the height of the transverse crests of the posterior upper molar, the anterior, or the arched one, rising to a high cusp at its outer extremity. A small tubercle exists on the side of the inner angle of the grinding surface in the penultimate molar. The same angle is much elevated in an anterior molar. The canine is wider distally than in *L.*

cornutus, and less recurved. The mastoid process is quite prominent. The humerus has a prominent internal condyloid ridge and tuberosity, and the condyles are not very oblique. The inner posterior lobe of the tibial face of the astragalus is quite well defined; there is no median ligamentous pit on the trochlear face.

Measurements (from Leidy).

	Inches.
Depth lower jaw at last molar	3.25
Length humerus about	21.
Diameter at condyles	7.50

Found by Dr. J. V. Carter and Dr. Leidy near Fort Bridger, Wyoming.

Dr. Leidy has suggested that this species and the *Dinoceras mirabilis* of Marsh are identical.

UINTATHERIUM MIRABILE. Marsh.

Dinoceras mirabilis, Marsh, Amer. Journ. Sci. Arts, 1872, October (published Sept. 27). Loc. cit. Jan. 28th, 1873.

The cranium of this species has been very partially described as above cited, but from figures in the last named paper, largely supply the deficiency. From this it is evident that it differs from *Loxolophodon cornutus* in the generic characters already mentioned, and, further, in the anterior position of the naso-maxillary horns, the perforation of the lachrymal, the anterior development of the malar, the oblique occiput, &c. It differs from the *E. pressicornis*, besides the inferior size, in the shorter nasal bones and greater posterior approach of the pre-maxillary bones to the base of the horns; in the much shorter horns and greatly smaller part taken in their composition by the nasals.

These differences account for the great number of errors committed by Prof. Marsh in his allusions to other species, especially *Loxolophodon cornutus* described by me (see his second article above quoted).

Measurements (from Marsh).

	M.
Length of cranium (28.5 inches)	.722
Width over orbits	.202
" between summits naso-maxillary cores	.169
" " " nasal "	.038
Height naso-maxillary cores (3 inches)	.075
Length canine (9.25 inches) below jaw	.232
Diameter fore and aft at base	.064
" transverse " "	.025
Length of molar series	.150
Last superior do	.036

UINTATHERIUM LACUSTRE. Marsh.

Dinoceras lacustris, Marsh, l. c. October, 1872. (Published September 27th, 1872.)

I have several of the teeth and the occipital, parietal and other portions of the cranium of this species. It is distinguished from its congeners, apart from its smaller size, by the large size of teeth. These are nearly as large as those of *Loxolophodon cornutus*, and considerably larger than those of *U. robustum* and *U. mirabile*. The occipital condyles are not larger than those of the Elk, Cervus canadensis. The mastoid protuberance is prominent, and the post-glenoid process more produced downwards and with less fore and aft diameter than in the other three species. The inferior temporal ridge is strongly marked, and the posterior condyloid foramen is large.

The posterior molar has a wide floor extending from the posterior or straight transverse crest to the cingulum. This crest is low and has a low tubercle near its apex behind. The other molars have strong fore and aft cingula but none at ends. The worn surfaces are first V-shaped, later arrow-shaped. The first premolar has curved outer crest and inner conic tubercle.

Measurements.

	M.
Diameter of occipital foramen and condyles	.092
From exterior end condyle to mastoid	.058
" " " " to post-glenoid process	.080
Transverse diameter last upper molar	.045
" " third premolar	.029
Length molar series	.163

Found by the writer in the Bridger formation of South Bitter Creek, Wyoming.

MEGACERATOPS. Leidy.

Proceedings Academy Natural Sciences, 1870, p. 1. Hayden's Geological Survey, Wyoming, 1872, 352 ("*Megacerops*").

This genus is only known from the extremity of the nasal bones bearing the horn-cores. The latter are intermediate in position to the nasal and naso-maxillary horns of *Eobasileus, etc.*, and may represent the median pair, in which case, the diagnosis of the genus should be, nasal horn-cores wanting.

The genus was originally regarded by Dr. Leidy as allied to *Sivatherium* and therefore Ruminant; he also supposed that it possessed a proboscis "as in the tapir." The latter proposition has much in its favor, especially as the affinities of the genus are evidently with the *Proboscidia*.

MEGACERATOPS COLORADOENSIS. Leidy.

Megacerops Coloradoensis. Leidy, l. c.

The part of this species preserved, indicates an animal of the size of

the largest *Uintatheria*. The nasal bones are coössified, and the horn-cores are sub-cylindric, obtuse and about two inches in length. They are situated above a point a little behind the anterior nares.

Pantodonta.

As already pointed out, the structure of the limbs and feet in this suborder is as in the order generally, and the scapula has the same form in general. There is also a resemblance in the form of the symphysis mandibuli, which though furnished with teeth, forms a long solid spout comparable to that of the Elephant. The astragalus has a very peculiar form, being even more exceptional than in *Uintatherium*. The superior articular surface is flat or concave in the middle. It is turned inwards in front of the articular face for the inner malleolus, terminating in a long point. The cuboid articular face is quite small and sublateral. The fibular facet is extensive, and the internal lateral well marked.

On the other hand the coracoid process is produced into a curved hook, and is thus more largely developed than in other Proboscidians or Perissodactyles. The neck is longer than in the other Proboscidians, and the parietal bones appear to be narrowed by the approximation of the temporal fossa, as in the *Rhinocerus*. Almost nothing however is known of the structure of the skull.

The genera are two, as follows:

Penultimate molar unlike the last, with external crescent and embracing ledge..... *Bathmodon.*

Three molars alike, with two transverse crests not meeting within..... *Metalophodon.*

BATHMODON. Cope.

Proceedings American Philosopical Society, 1872, p. 417.

This genus was originally chiefly distinguished by the dentition; at present many other important peculiarities are added. First, as regards the molar teeth; the two transverse crests I find to be separated (not united) at their inner extremities, by a narrow fissure. The anterior is much the longer, and is curved; its anterior wall slopes steeply down to the narrow cingulum. The posterior is short, and straight, and bears a crest. The numbers are I. 3; C. 1; P. M. 4; M. ?3.

The entire mandible presents the following dentition; I. 3; C. 1. P. M. 4; M. 3. The incisors radiate round the narrow extremity of the trough-like symphysis, and have transversely expanded crowns. The canine is inclined forwards and forms part of the same series. Its crown is triangular in section, the outer face convex. In the males it was enormously enlarged as indicated by a symphysis in my possession. The anterior premolar approached the canine. The former teeth have an external chevron directed inwards, whose extero-superior surface of enamel is acute cordate. Beside this is a little longitudinal ridge, which represents

another chevron of the true molars. On the first of the latter, both chevrons are developed, the posterior the least, both with their anterior ridge boundaries lowered; they sink entirely on the last two molars, which become thus two crested as in those of some Tapiroids and the premolars of *Dinotherium*.

The sternal segments are cylindric; in one the articulations for the hæmpophyses project laterally, giving the piece a T-shaped form. The atlas has a flat diaparapophysis, presenting its edges fore and aft; the arterial canal traverses it obliquely. The coracoid is double, having a tuberosity on the edge of the glenoid cavity, and a prominent hook just outside of it. The lumbar vertebræ are quite short. The cuneiform bone is narrow pyriform, with two triangular facets on one side, the smaller being sublateral; and one twisted over the other. The ungueal phalanges are very short, somewhat flattened and with the terminal portion transverse and rugose as in some toes of *Palæotherium*.

In the remains pertaining to this genus obtained by Dr. Hayden, there are numerous individuals of apparently three species. Two of these are larger and one smaller, the latter in part indicated by an individual without epiphyses on the lumbar vertebræ. It presents marked difference in the form of the astragalus atlas, scapula, etc.

a Larger species.

Astragalus everted in front; nearly as wide as long; lower premolars narrower, more elevated and rugose... *B. radians.*

Lower premolar broad, lower, and smooth..... *B. semicinctus.*

aa Smaller species.

Astragalus much wider than long, decurved in front.. *B. latipes.*

Bathmodon radians. Cope.

Proceedings American Philosophical Society, 1872 (February 16), p. 418. Hayden's Geological Survey of Montana, 1871, 350.

In addition to the characters already assigned to this species as above cited, I add the following:

The apex of the *scapula* is a massive flattened acumination with truncate extremity. The spine is elevated and truncate next the glenoid cavity, which is a wide oval, much produced at the coracoid margin. The transverse process of the *atlas* is rounded distally and is about as long as wide; the surface for the axis is directed obliquely inwards. The *fibula* has the inner sharp edge prolonged to the proximal end; the form of the latter is much as in *Eobasileus*. The *astragalus* is slightly concave in both directions on the trochlear face, most so antero-posteriorly. The anterior outline of the same is strongly and obliquely convex, and the surface is produced sideways into a latero-anterior apex. The inner malleolar border is thus very concave; the outer is gently convex with a long fibular facet. The posterior margin concave, the inner tuberosity

prominent. The *navicular* facet is as broad as long, and nearly sessile, being probably separated by a groove from the tibial. The cuboid facet is subround, small and sublateral. The calcaneal situated diagonally opposite each other. The antero-internal is twice as large as the other, is transverse and truncate internally by a facet near the apex, at right angles. The other calcaneal facet is subround.

Measurements.

	M.
Length ramus mandibuli to anterior margin of coronoid process	0.310
Length premolars and molars	.218
" last molar crown	.040
Width " " "	.030
" " premolar crown	.018
Length last premolar	.025
Width symphysis at canines	.045
Diameter canines ♂	.028
" " ♀	.023
Length exposed portion incisor 2	.026
Width crown " "	.0245
Length diapophysis atlas	.047
Width " "	.056
" facet for axis	.053
" glenoid cavity scapula (straight)	.086
Length coracoid from inner basis	.045
" proximal articulation fibula	.027
" distal " "	.042
Diameter shaft "	.022
Total length astragalus (fore and aft)	.072
" width "	.065
Length navicular facet	.045
Width " "	.034
" cuboid "	.025
Length " "	.023
" anterior calcaneal do	.040
Width " "	.024
Length posterior "	.021
" fibular (axial)	.043

The teeth are slightly rugose, and the inferior canines show a tendency to imitate the form of the incisors in a slight basal angular expansion of the crown. This forms an approximation to the tapirs. The middle pair of incisors is directed outwards, is the smallest, and like all the others has the roots much exposed.

This species was originally described from teeth of the upper jaw. I have since obtained the entire mandible (except the angles) taken out at

the same place and near the same time. The size, color, etc., would indicate that they belong to the same individual. Accompanying the first specimens were many bones of individuals of different sizes, which I learn from the finder were all taken from within a short distance of each other. Many of them belong to the same species, as the jaws and teeth, and I have described as such those that relate properly to them as to size, mineral appearance, etc.

The smaller specimens belong also to several individuals, and possibly to more than one species. I describe them together, but regard the astragalus as the primarily distinctive bone.

BATHMODON SEMICINCTUS. Cope.

Proceedings American Philosophical Society, 1872, p. 420. *Loxolophodon semicinctus*, Cope, l. c.

The tooth on which this species was based shows a near relation to the corresponding one of *B. radians*.

BATHMODON LATIPES. Cope. Species nova.

Established on atlas axis, dorsal and lumbar vertebræ, scapula, humerus, phalange, femur, astragali, etc., of a specimen found with the *B. radians*.

The transverse process of the atlas is stouter and less flattened at the base than in *B. radians*. The axis is but little oblique and has a low obtuse hypapophysis below. Its form is much as in the larger species, being rather elongate, but shorter than in *Rhinocerus* and other Perissodactyles. The dorsals and lumbars are short and plane; the former are obtusely, the latter acutely keeled below. The head of the femur has no ligamentous fossa. The astragalus is considerably broader than long, the apex turned outwards in front of the inner malleolus, being especially produced. The tibial face is concave transversely, and convex anteroposteriorly at the front, plane behind. There is a posterior submarginal foramen, which is not bridged over in one specimen, producing a deep notch. The navicular facet has considerable transverse extent, and the anterior side of the bone is more transverse than in *B. radians*. The calcaneal facets are diagonally opposite to each other; the outer is subround, the inner anterior narrow and transverse. It differs in the two specimens, the perforating foramen not being bridged over in the one (the type) with the similar posterior interruption described above. This may be due to fracture. The only ungual phalange has the articular face not quite sessile on the transverse rugose free extremity.

Measurements.

	M.
Diameter diapophysis atlas (fore and aft)	0.036
" axial facet of "	.034
" centrum axis (transverse)	.080
" " " (vertical)	.037
Length " " to odontoid	.057

Width neural canal do		.030
Diameter of centrum of dorsal	fore and aft	.040
	vertical (total)	.043
	transverse	.059
" neural arch of same	vertical	.018
	transverse	.032
" centrum of lumbar	antero-posterior	·041
	vertical (total)	.050
	transverse	.063
" head of femur		.060
Length astragalus fore and aft		.050
Width "		.065
Length navicular facet		.049
Width " "		.020
" cuboid "		.018
Length " "		.016
Width (fore and aft) anterior calcaneal		.018
Length posterior calcaneal facet		.022
" fibular (axial)		.041
" terminal phalange		.012
Width do proximally		.015
" distally		.030
Diameter glenoid cavity scapula	vertical	.051
	transverse nr	.080

From the beds of the Green River epoch near Evanston, Utah (now Wyoming).

METALOPHODON. Cope.

Proceedings American Philosophical Society, 1872, p. 542. (Published September 20th.)

In distinguishing this genus from *Bathmodon*, I stated that the differences were in the dentition so far as known; *i. e.* that the crests of the true molars are not united internally and that the premolars are two—not three—crested. I would now add to the characters, that there are three molars on each side, with transverse crests, which do not unite at the apex, except in the case of the anterior, when they are slightly connected. In *Bathmodon* there is but one such tooth, the posterior. The inner or third crest of the posterior premolar of that genus is only a cingulum, and is not probably a generic character.

Metalophodon armatus. Cope. Loc. cit.

This species is represented by the greater part of the dental series of both jaws, which I took from a decayed cranium myself, and can thus be assured of their mutual relations. One of the true molars at least, belonged to the milk series, as indicated by the unworn crowns of the successional teeth accompanying. Some of the premolars are but little worn. Referring to my original essay for the general description, I append exact

Measurements of the Teeth.

	M.
Total length of a superior incisor	.057
Length crown (inner face) superior incisor	.015
Width " (oblique) " "	.020
" " " inferior "	.023
Length " (inner face) " "	.018
Width canine .030 from tip	.020
" posterior molar	.039
Length " "	.028
Elevation posterior crest do	.016
Width anterior true molar	.035
" premolar	.028
Length "	.0215
" " (first)	.016
Width " "	.008
Length " (inferior)	.024
Width " "	.020
" penultimate lower molar	.023
Length " " "	.037

It is not certain that the last named species of *Bathmodon* does not belong to this genus. All three are distinct from the *M. armatus*, the latter though young, being considerably larger than *Bathmodon latipes*.

Appendix.

The materials on which the preceding determinations are based, were obtained by the Geological Surveys conducted during 1871–2, by Prof. F. V. Hayden, U. S. Geologist.

The papers descriptive of fossils from the Wyoming basin published by the writer during the year 1872, were issued at the following dates:

On *Bathmodon*, an extinct genus of Ungulates, February 16th.

On a new genus of *Pleurodira* from the Eocene of Wyoming, July 11th.

On the Tertiary coals and fossils of Osino, Nevada, July 29th.

Descriptions of some new *Vertebrata* from the Bridger Group of the Eocene, July 29th.

Second account of new *Vertebrata* from the Bridger Eocene, August 3d.

Third account of new *Vertebrata* from the Eocene of Wyoming Territory, August 7th.

On the existence of *Dinosauria* in the Transition beds of Wyoming, near August 12th.

Notice of *Proboscidians* from the Eocene of Southern Wyoming, August 19th.

Notices of new *Vertebrata* from the upper waters of Bitter Creek, Wyoming Territory, August 20th.

Second notice of extinct *Vertebrates* from Bitter Creek, Wyoming, August 22d.

On the Dentition of *Metalophodon*, September 20th.

On a new Vertebrate genus from the northern part of the Tertiary Basin of Green River, October 12th.

Descriptions of new Extinct Reptiles from the Upper Green River Eocene Basin, Wyoming, October 12th.

The above essays were distributed widely at the above dates, excepting that on *Metalophodon*.

In an article on *Uintatherium mirabile*, Prof. O. C. Marsh criticizes the statements made in some of the above essays, denying their accuracy. In reply to such of them as are not frivolous, I would say that I make no corrections of them at present (except one, which I made prior to the appearance of his remarks), but show that his statements were based on species different from those described by me. These he has either not seen or not studied.

In applying the law of priority in nomenclature, I have endeavored to practice the rules adopted by the majority of students, and which I believe to be founded in justice. They are as follows:

(1.) Priority reposes on date of publication not on reading of memoirs.

Note. What is necessary to determine the time at which a discovery of scientific truth is made, is the earliest reliable evidence of such discovery. As verbal and written assertion cannot be preserved inviolate, printing is necessary to secure the record from change. The earliest evidence of such printing is that offered by printers, who issue the work, and any person who receives it from them. It is then published. Ordinary books bear such date of publication, whether distributed, sold, or standing on the author's shelves.

(2.) In order that a specific name be adopted it must be associated with a description of the object to which it refers.

Note. The necessity of this rule is self evident, since the only value of scientific literature is to convey definite information, which a name does not. Moreover the worst description will generally embrace at least one peculiarity of a species, which will serve to fix the name, but a label, or the specimen itself, may readily be lost or transposed in a museum. Further, in writing descriptions it is necessary to introduce as many points as possible, not only to distinguish the species from those already known, but from those which may in future be discovered; for it is with these that difficulties chiefly arise.

(3.) In order that a generic name be adopted, it also must be accompanied by a description.

Note. Since naturalists differ to some extent as to what they term a genus, some may be disposed to doubt the expediency of this rule, but its importance to science appears to me greater than in the case of species. In the first place, scientific literature being designed for the communication of exact knowledge, it is essential that its words should represent ideas. The genus is as definite a mental conception as a species, to the *scientific* thinker, and in proposing a name, should also express what it

represents in his mind. Without such expression it is safe to suppose that no such idea exists ; and if so, the name should be regarded as a cipher in the literature of science.

That certainty as to the limits and hence definition of a genus is not at once attainable, is no objection to the above rule. By study of known forms definite knowledge of generic characters may be attained by proper analysis. But whether correct or not, a generic description expresses something definite, and gives the name a currency which should remain as a record of honest work.

The evils which come from the opposite course are numerous. They are : 1st. Names without description are unintelligible, and communicate nothing. 2d. They serve to conceal the ignorance or incompetency of their authors. 3d. If allowed, they open the door to the introduction of names on geographical and stratigraphical grounds ; a slovenly pratice, indulged in by a few palæontologists, and properly denounced by Falconer, as assuming at the outset what it is the design of the science to prove. The same practice attempted in zoölogy has been utterly condemned. as for example in the case of the System Reptilium, published in 1843. Here pages of generic names may be found, with type species indicated, which have no authority whatever. 4th. The practice lays the science open to the inroads of charlatans and scientific pirates, who seek to impose a nomenclature without the labor of discovering a system or describing its objects. 5th. As the genus is a more important conception in palæontological science than the species, it is more important that what its name represents should be clearly understood, otherwise generalizations become impossible or incomprehensible.

(4.) When a supposed genus is found to consist of several, and the author has stated what he regards as the type of the former, that species must retain the original name. Where the type of the original genus is unknown, the original name must attach to that genus which remains, after subtraction of the others found to be embraced in the original assemblage.

Note. This rule is adopted as doing less violence to long accepted views and practice in nomenclature than any other. While recognizing the work of the original author, it also preserves record of the labor of those who have determined the true divisions with more exactitude.

Explanation of Plates.

Pl. 1. *Loxolophodon cornutus*, Cope, profile less than one-sixth natural size.

Pl. 2. The same from the front.

Pl. 3. Superior view of the same.

Pl. 4. Inferior view.